



# A DATABASE ABOUT THE TORNADIC ACTIVITY IN CATALONIA (NE SPAIN) SINCE 1994

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**INTRODUCTION.** Although tornadic activity is not the most important hazard in Spain, the damages generated by tornadoes and downburst have been considerable in urban areas. Balearics and Catalonia are some of the regions with high frequency of severe thunderstorms in Spain (Gaya, 2005). Most of these tornadoes or downbursts are weak and their paths are often limited, but some strong tornadoes have affected urban areas and its social and economic impact have been important. In some occasions it is difficult to separate the damages produced by the tornado itself from those produced by other associated hazards like heavy rains, hail or a wind storms. In this poster, a preliminary climatology of tornadoes and waterspouts affecting Catalonia in the last 15 years is presented.

PLATES 1 and 2. The Catalan newspaper Avui shows a photograph whit two tornadoes over the Barcelona airport in 2005. A small car turned by a tornado in September 2006. (© Castan)



**DATA BASE.** To have a good systematic data base about tornadoes is necessary, before to obtain some conclusions not enough justified. This kind of database is not easy to obtain, because of it requires to have detailed information about damages, meteorological observations and testimonies that has to be filtered by a good quality control. It also needs to distinguish between damages produced by tornados or another meteors like heavy rainfalls or strong winds. The present work is the fruitful of a long work of compilation and identification, developed by Gayà, Arús and Castan), collecting information from newspapers, insurance companies and other meteorological sources. Many cases have been surveyed “in situ” in order to recognize the causing phenomenon of the damages and to infer wind speed.

The area considered is Catalonia, placed at the NE of Iberian Peninsula, characterized by three mountain ranges that favor the unstability development. In this work, the unitary region is the county, and the focused phenomena are tornadoes, waterspouts, and downburst. If a waterspout touched the shore and went inland, it was only considered as a tornado. In the same way, if there are coincidence of tornado and downburst, the

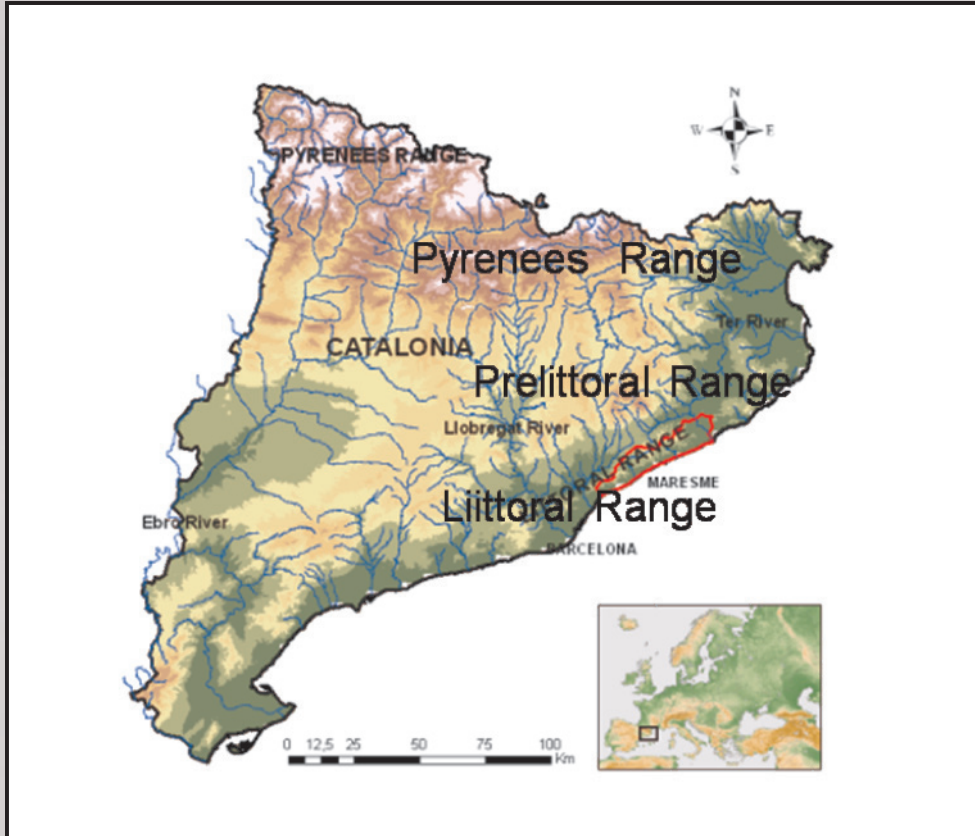


FIGURE 1. Main orographic features of Catalonia.

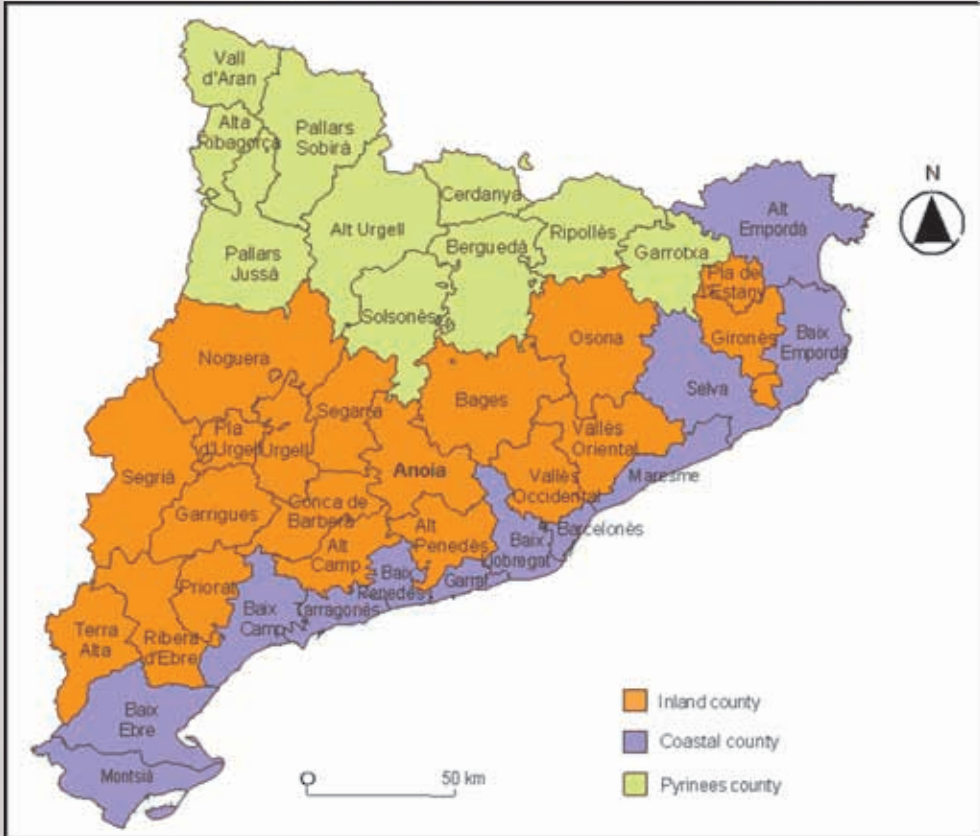
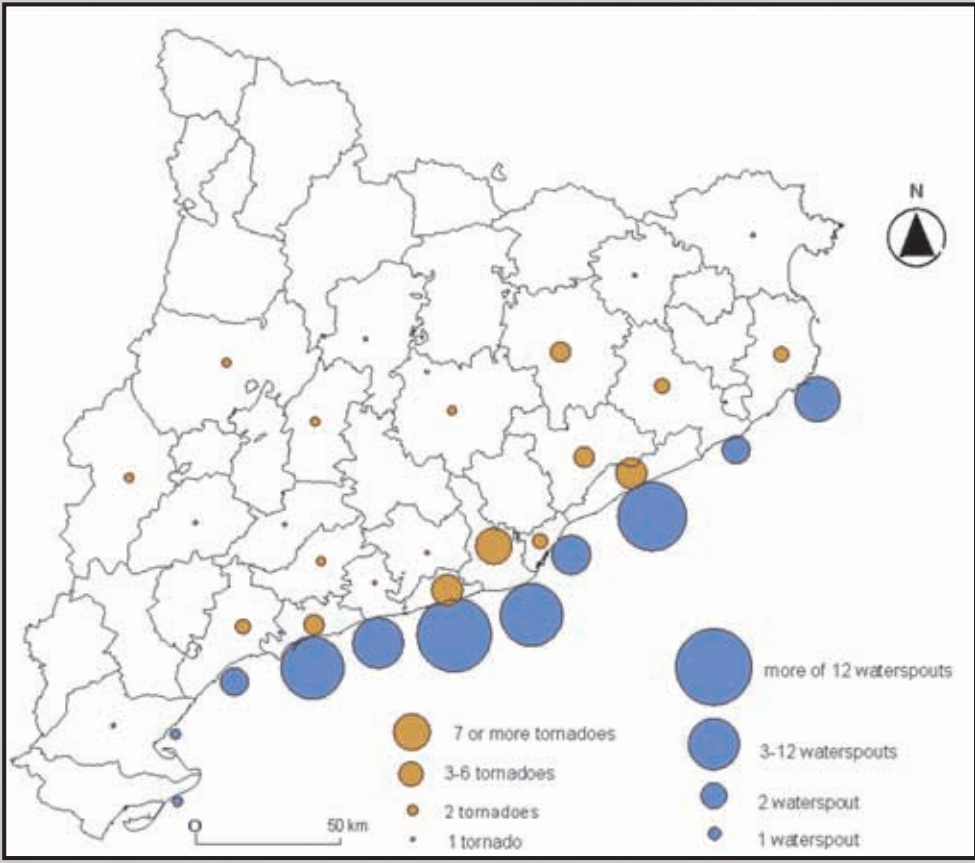
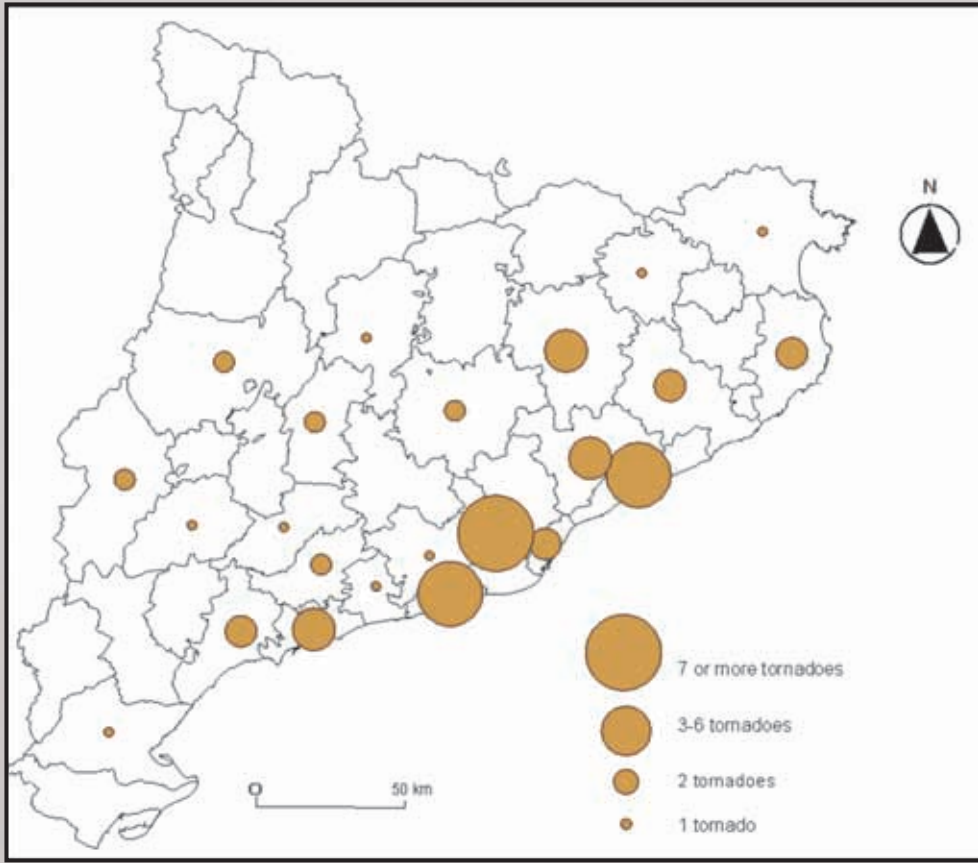
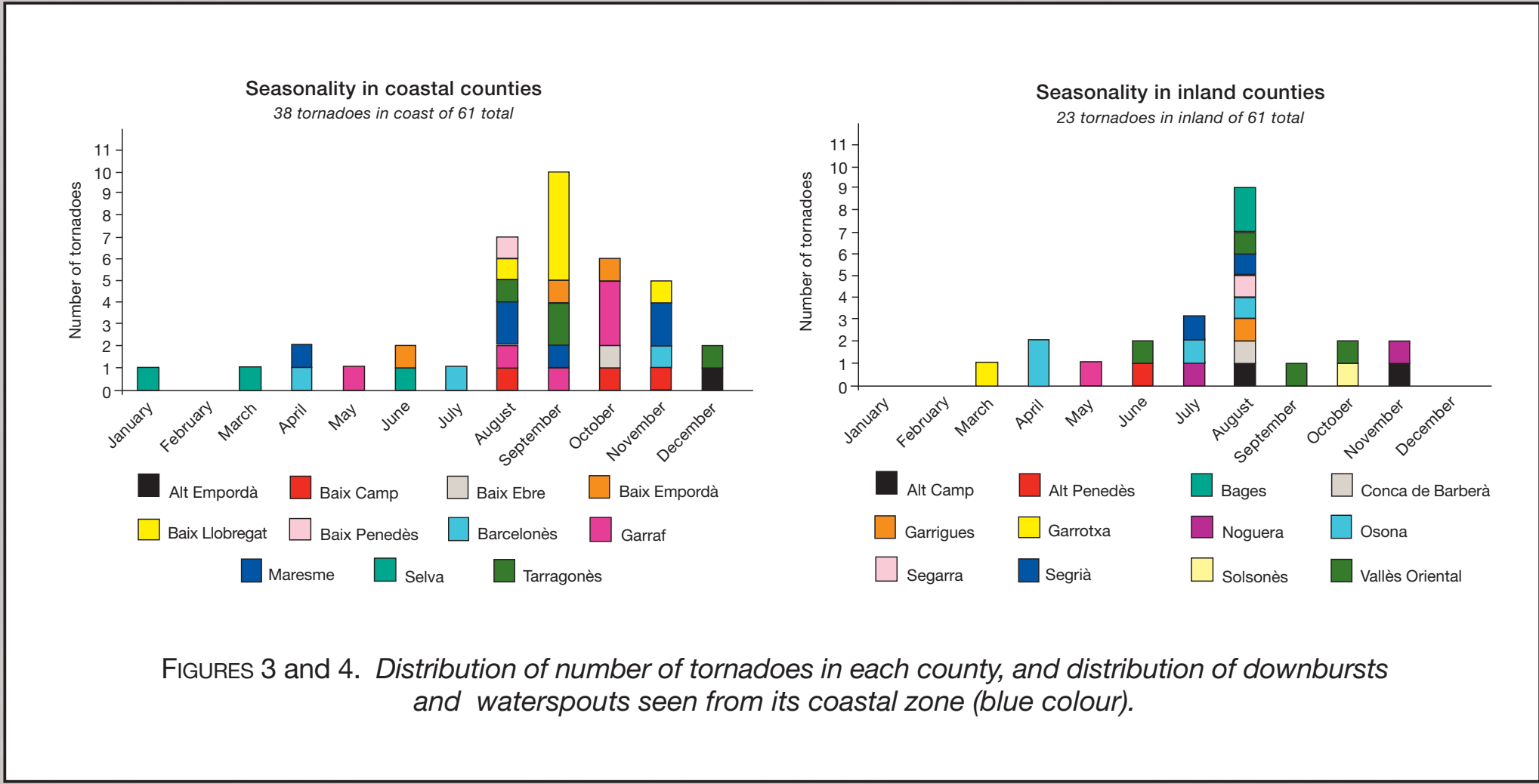


FIGURE 2. Map of Catalonia where counties are pointed out. More than 50% of the population is concentrated in the coast region (blue color).

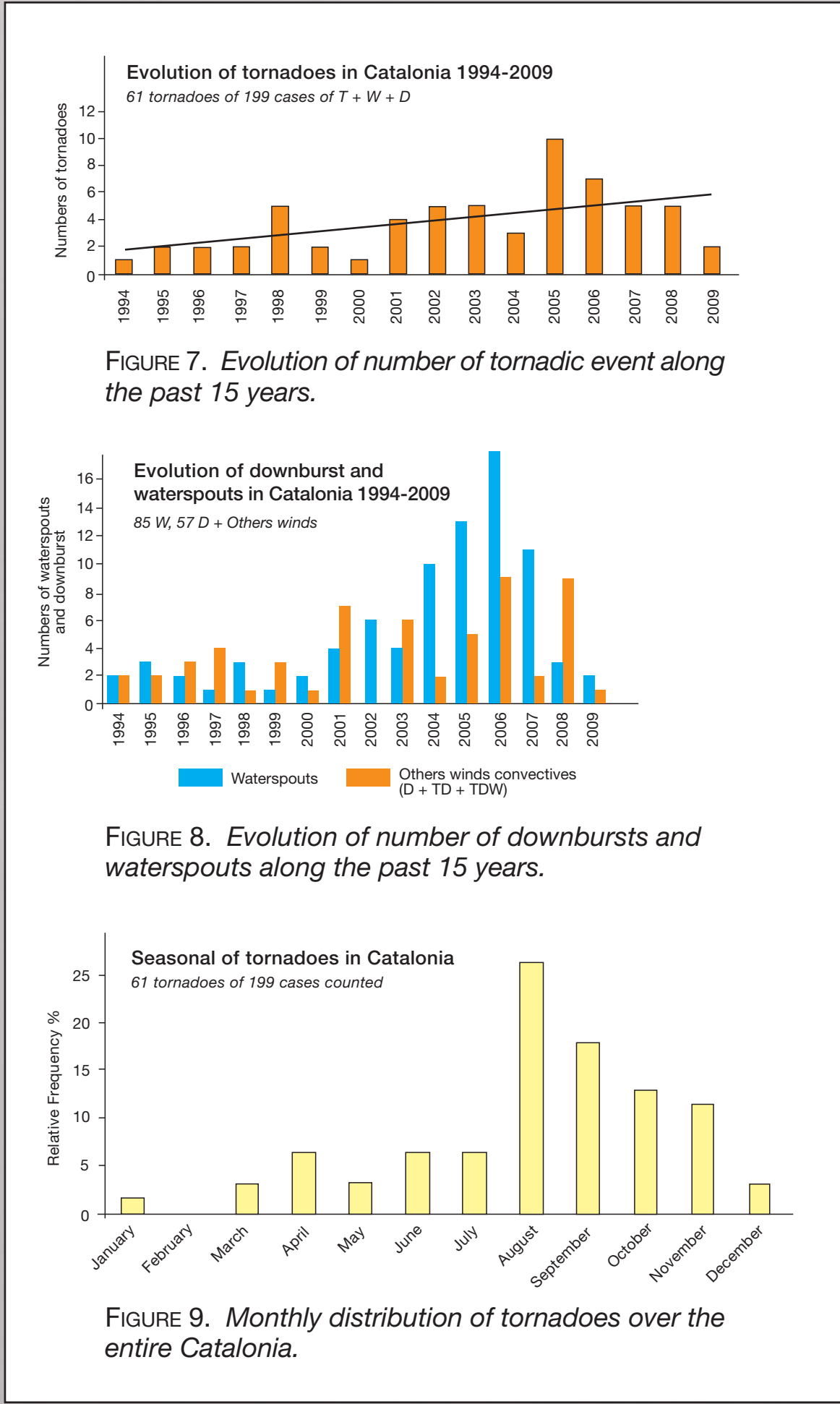


The database contains 199 cases of severe winds over Catalonia in 15 years. 61 of them have been tornadoes, 85 waterspouts, and 57 downbursts or other straight winds. The geographical distribution of tornadoes and downbursts presents a high tendency to appear close to the coastal counties where, moreover, there is greater population density. It is remarkable that Pyrenees counties have no incidence of this kind of severe weather. Probably, this is because population density is very low and, therefore, the information is more limited. Besides this, And, despite that Pyrenees are a region with high incidence of storms, these were not severe.

FIGURES 3 and 4. Distribution of number of tornadoes in each county, and distribution of downbursts and waterspouts seen from its coastal zone (blue colour).



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## STATISTICAL STUDY

The evolution of the tornadoes over de later 15 years offers a remarkable increase. But it is due to an extreme case in 2005 (an outbreak with 5 cases over Barcelona area in one day). Perhaps the true slop appears in 2001 with an average around 4 cases per year (or 4 tornadic days). Probably the most important factor is the quick increase of spotter information with photographs in local television and amateur's websites. The seasonal distribution presents a clear tendency over the months from August through November. But the distribution of other severe straight winds seems to be under-reported.

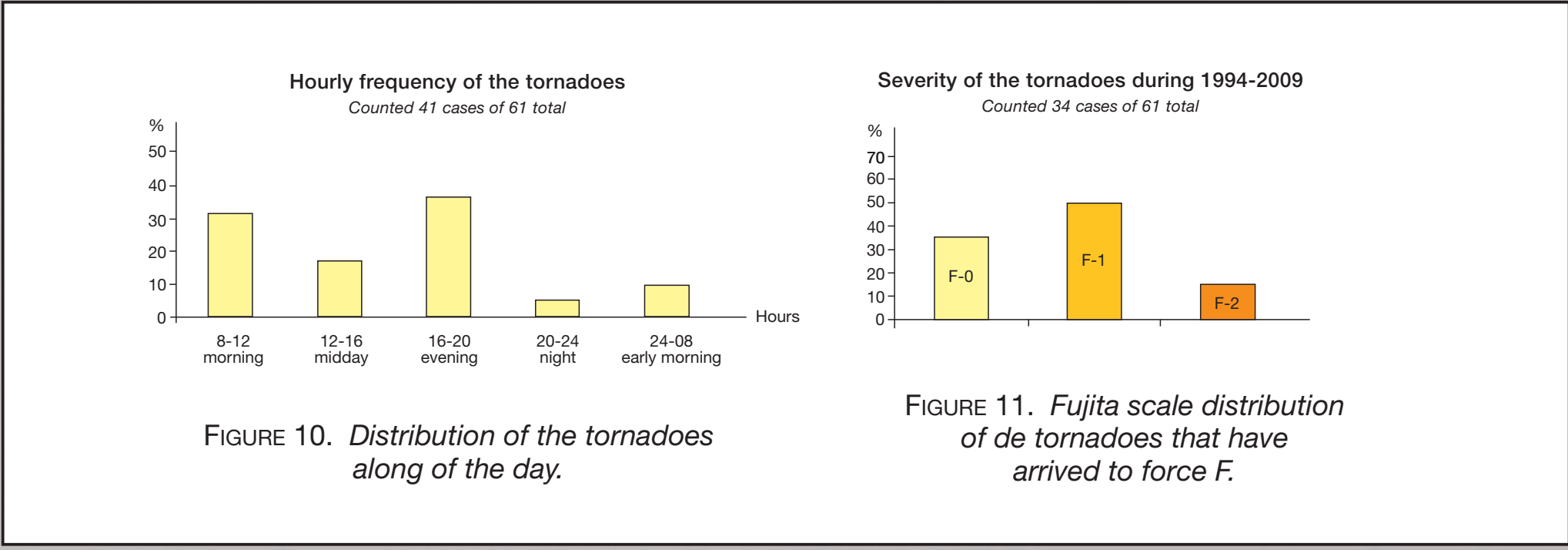


FIGURE 10. Distribution of the tornadoes along of the day.

FIGURE 11. Fujita scale distribution of de tornadoes that have arrived to force F.

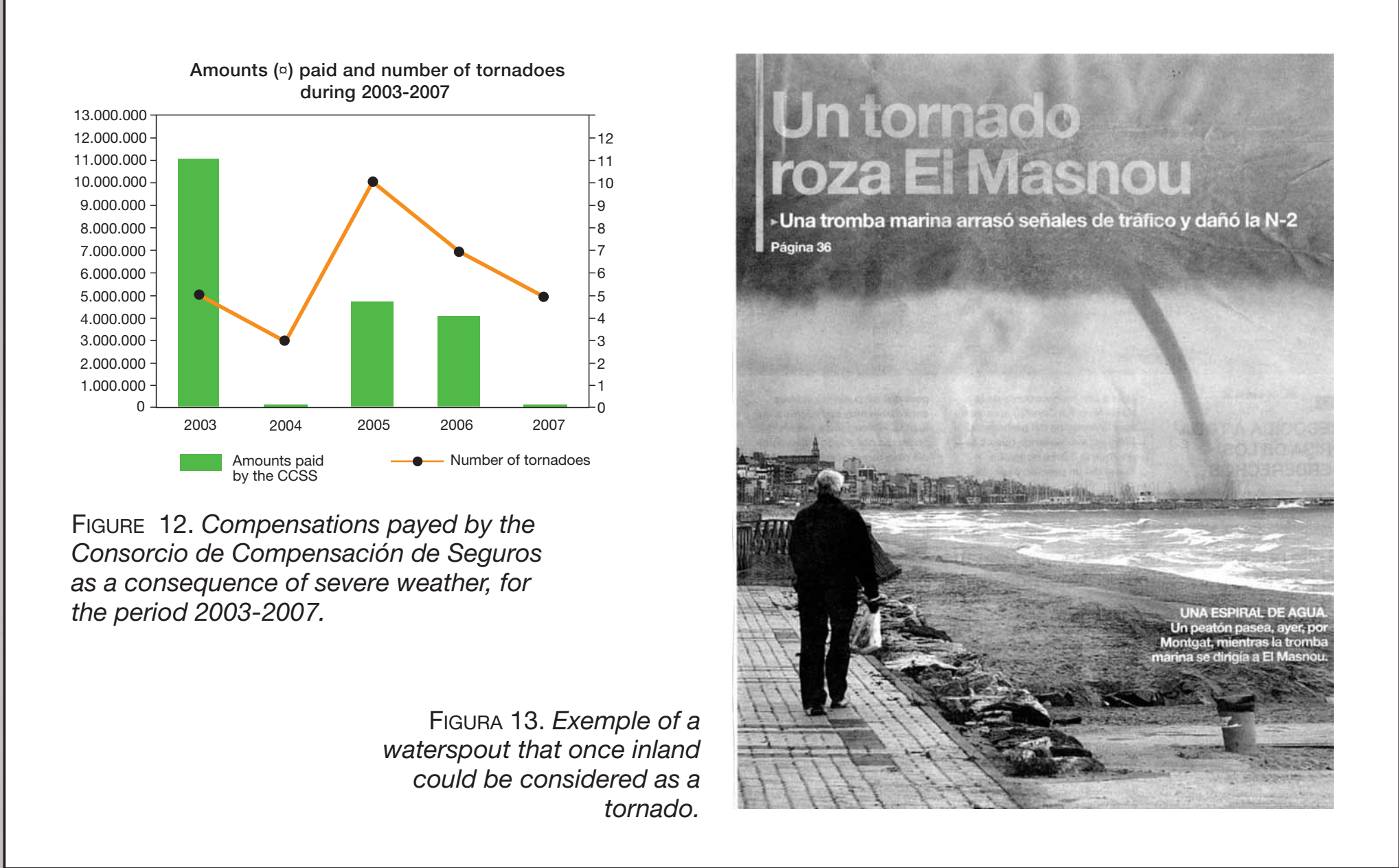


FIGURE 12. Compensations paid by the Consorcio de Compensación de Seguros as a consequence of severe weather, for the period 2003-2007.

FIGURA 13. Example of a waterspout that once inland could be considered as a tornado.

## CONCLUSIONS

There is an usual confusion between tornado, downburst and waterspout, due to the unexpertise of people and/or the lack of enough information and observations. Have a good database on tornados is not an easy task. In this work the experts have crossed their databases and have done all the required work field to characterize each event, building the first good quality database of tornadoes in Catalonia. An average of 4 tornadoes/year, 5,7 waterspouts/year and 3,8 downbursts/year has been found. The actual number of downburst are underestimated, but, in some databases they are usually confused with tornadoes. The major part of them are weak tornadoes that do not arrive to F-2, and any case have been upper F-2 during the period 1994-2009. They are usually produced between August and November. The major part of the tornadoes affect the coastal region, mainly in the Barcelona surrounding area. This fact can be related with a major detection and a major impact, due to the high population density in this region. However, a natural factor related with the hazard should be also considered. Some of the tornadoes birth over the sea as waterspouts and arrive at the coast where they are considered as tornadoes once they are inland.

There is a not clear trend in the number of tornadoes for the period 1994-2009. Years 2005 and 2006, were rich in tornadoes, some of them simultaneous to heavy rainfall events and floods.

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